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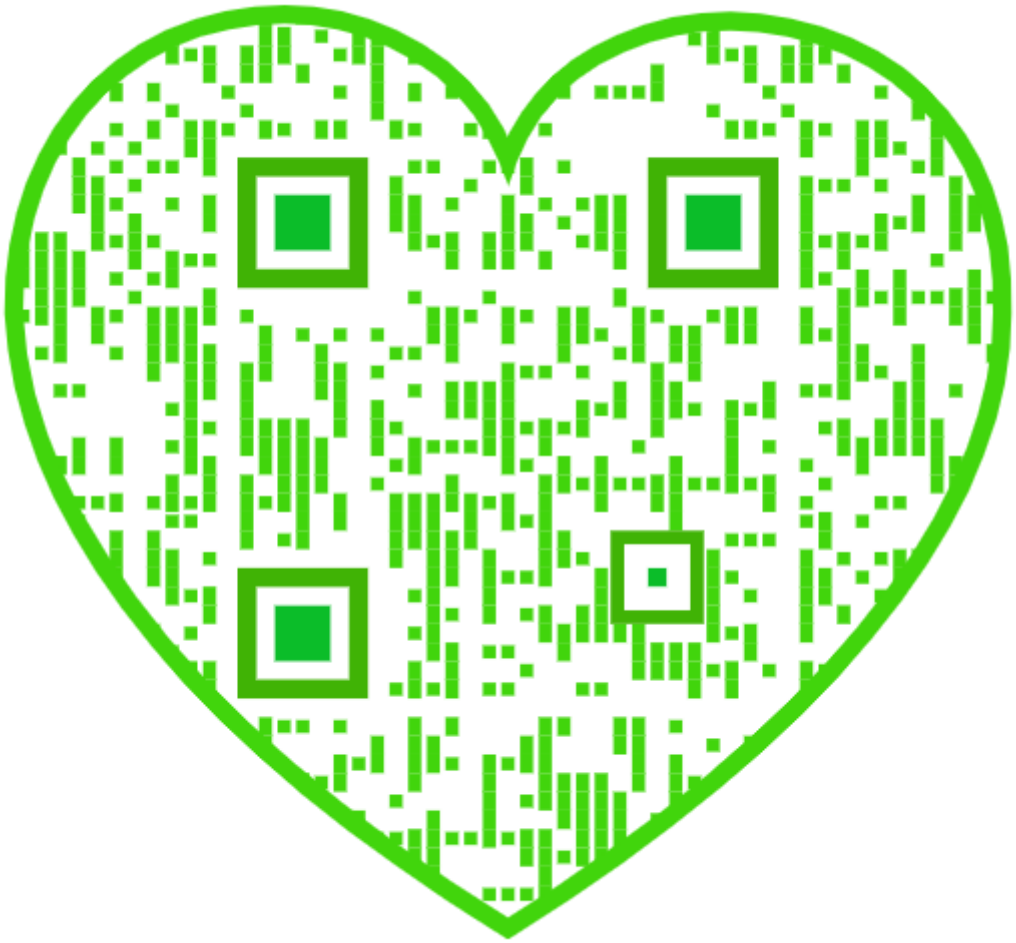

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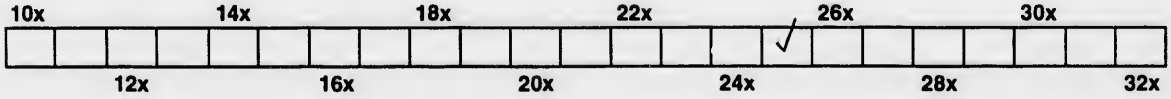

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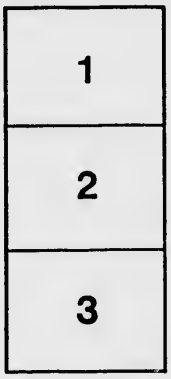

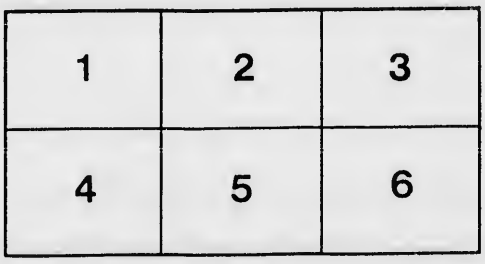

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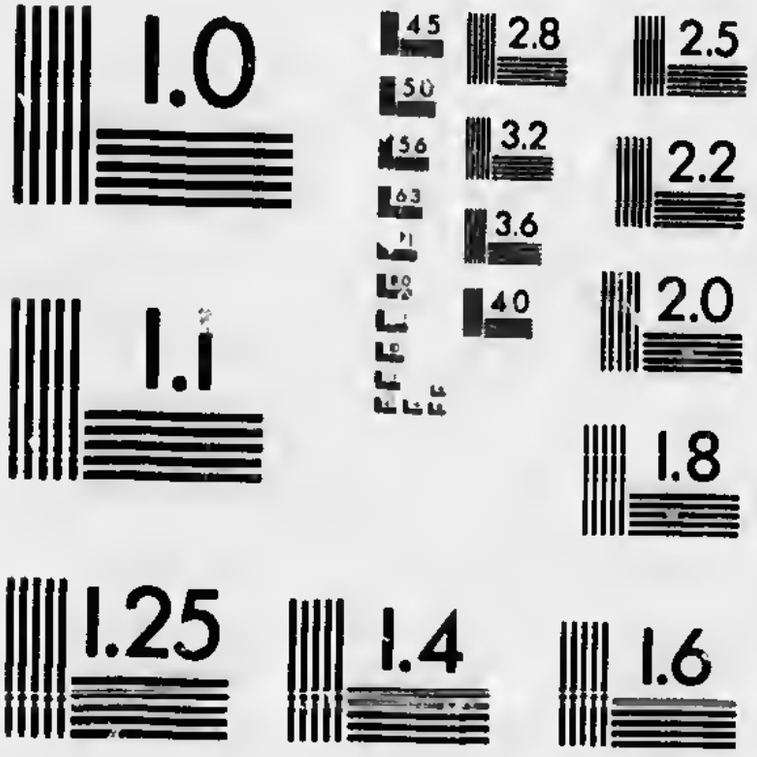

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BULLETIN No 5

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CHEESE MAKING

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
OF THE PROVINCE OF QUEBEC

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BULLETIN NO 5

CHEESE MAKING

RECEIVING THE MILK.—TESTING THE MILK BY THE CURD.—RIPENING THE MILK.—RENNETING.—CUTTING THE CURD.—EXPULSION OF THE WHEY AND REFIRMING OF THE CURD.—HEATING UP, STIRRING AND DRAWING OFF THE WHEY.—DRAINING OF THE CURD.—STIRRING, PACKING AND PILING.—GRINDING.—SALTING.—PUTTING INTO MOULD AND PRESSING.—CURING.—AROMA AND FLAVOR.—BODY AND TEXTURE.—COLOR.—DIMENSIONS OF THE MOULDS AND BOXES.—DEPRECIATION ARISING FROM THE PRINCIPAL EXTERIOR FAULTS.—CARRIAGE.—QUANTITY OF MILK NECESSARY TO START A CHEESERY AND RATE OF CHARGE FOR MAKING.—JUDGING AND EXAMINING CHEESE. — PRINCIPLES OF THE CONSTRUCTION OF CHEESE-FACTORIES. — PLANT REQUIRED FOR CHEESERY OF 500 COWS.—CLEANLINESS, VENTILATION AND MAINTENANCE OF CHEESERIES.—COMPOSITION OF CHEESE AND OF THE RESIDUES FROM ITS MANUFACTURE.—YIELD OF CHEESE FROM MILK.

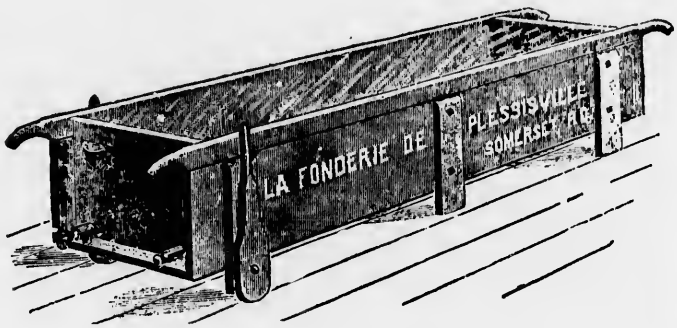
Reception of milk.—To have good cheese, the first condition is to have good milk, and cheese-makers cannot be too strict in rigidly refusing all that has a bad smell, a bad taste, or is too stale. There is no excuse for accepting such. The care that ought to be devoted to milk by the patrons has been already explained in connection with butter. Stir the milk occasionally while receiving it, to mix the different lots and to prevent the cream from rising.

Testing the milk by the Curd.—It is often necessary in cheeseries, particularly during the summer heat, to have a means of discovering the cause of the abnormal fermentations of the milk which manifest themselves in the shape of a spoiled curd, full of holes and floating.

The cause of these accidents invariably arises from the milk supplied by some careless patrons, who are not scrupulous about sending to the factory the milk of sick cows or dirty and turned milk. The "Curd Test" assures the detection of such milk even in cases where experienced manufacturers fail to recognize it either by appearance or smell.

This test has been fully described in Bulletin No 2 on milk issued by the Department of Agriculture. .

Ripening the milk.—Before renneting, the milk ought to have attained a certain degree of acidity; this can be determined, either by the acetometer which we have described already in Bulletin No 2 or by the rennet-test. Milk should be so far advanced that it curdles in a number of seconds, so that the whey may run off in the space of 2 ½ to 3 hours from the renneting, and that the curd gives ¼ inch of acid by the hot-iron test.

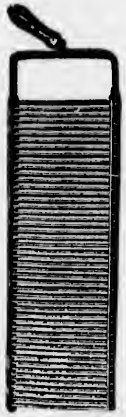


(Fig. 1) Cheese Vat.

To try by the rennet test, take 8 oz. of milk from the vat, add a drachm of rennet-extract, and stir it quickly for ten seconds. If it curdles in 17 to 20 seconds, the milk is ripe enough for renneting. There is necessarily some

variation between one district's milk and another's, but a few tests will teach the maker how much allowance to make. To be perfectly accurate as to the moment of curdling, it is only necessary to throw the end of a burnt match on the surface of the milk, in stirring which, the match will receive a rotatory motion on the surface of the milk, and this will cease the moment curdling takes place.

Renneting.—At the moment of renneting, the milk should be at a uniform temperature of 86° to 88° F., rather lower in spring, rather higher in the fall: spring 86° fall 88°.



(Fig. 2).
Horizontal Curd Knife.

(Fig. 3).
Vertical Curd Knife.

Add enough rennet (3 to 4 oz. per 1,000 lbs.) to turn the milk in 15 to 20 minutes in spring, 30 minutes in summer, and 40 in autumn. Mix the rennet with water at 60° to 65°, and stir the milk for some minutes before and after renneting.

Cutting the Curd.—First use the horizontal knife and then the vertical. The curd is fit to cut when it breaks clean before the finger. The dice

into which it is cut are to be about ¼ inch cubes, and care must be taken not to make what the Americans call a "mush" of the curd. In summer, the curd may be cut a little sooner, and if the milk is very much advanced, it may be cut finer, which will admit of the heating up being done sooner.

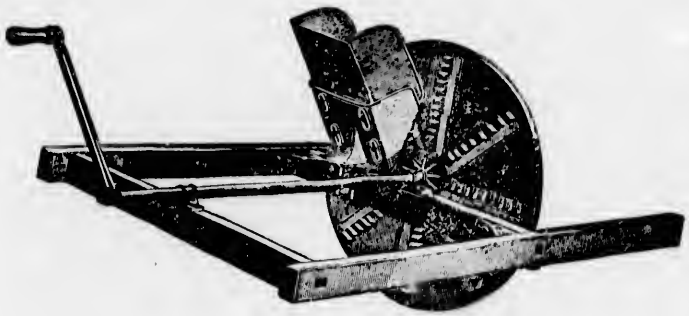
Expulsion of the whey ; re-firming of the curd ; heating-up, stirring, and drawing off the whey.—Stir for 10 to 15 minutes, detaching the curd from the bottom and sides of the vat. Stir slowly and carefully, so as not crumble the pieces of curd ; then set the agitator to work and begin to heat up. This should go as high as from 98° to 106° in summer ; to 98 °in the spring and in autumn 100° to 106°. Mr. E. Bourbeau, professor of cheese-making at the St-Hyacinthe Dairy School, lays down the following rule : The curd should be heated up to a high enough temperature that, after remaining 2 ½ hours in the whey, it may be sufficiently firm to require only little work to drain it. This temperature varies between 98° and 106° Farenheit. The heat is advised to be raised at the rate of one degree per 4 or 5 minutes, though in autumn the rate should be a little less, and when the milk is already very forward, the heating should be a little faster. Stir and increase the pace of stirring as the heating advances. Stir during five minutes more after shuting off the steam. Then let off part of the whey in order to prevent any surprisal by the possible rapid development of acid. If any smell in the curd becomes perceptible, no more whey must be left than just enough to permit of the curd swimming in it without sticking ; then air the curd well by quick stirring ; by thus acting. the aroma will be improved. When there is any show of gas, stir vigorously. Then try the curd by the hot iron and finish drawing off the whey when the test shows ⅛ to ¼ of an inch of acid in spring, ¼ to ½ in summer, and ⅜ to ½ in the fall. While the whey is running-off, the curd is to be stirred by hand. The drawing-off should go on quickly, so that the acid may not exceed the above quantities.

The hot iron test consists in the application to or bringing in contact of a piece of curd with a hot iron ; when withdrawn, it leaves fine, silky threads adhering to the iron and these are all the longer that the curd contains more acid. They are guaged by the eye.

Draining of the curd, stirring, packing, piling.—As soon as the whey has run off, the curd is hand-stirred to facilitate the drainage, if the working in the whey has been properly done, there will be but little stirring

needed. When the curd has taken well, generally about half an hour, it must be cut into blocks which are to be turned several times, at intervals of 20 minutes and then piled. In the spring, at the end of April and in May, the piling must not be high ; in June, the piling may be 4 or 5 layers one above the other ; and in summer, when gas or tiny holes are visible, pile higher and turn oftener. In the fall, pile 5 or 6 layers high. All this ought to be done at a temperature varying according to the external heat, of 94° to 98°, but never higher than the latter. In autumn, in cold weather, cover the vat to prevent the curd cooling too much.

Grinding.—When the curd is mellow, it is fit to grind. It ought then by the hot iron test to give 1¼ to 2½ inches of acid : more in the fall, less in the spring. As soon as it is ground, it must be vigorously stirred to aerate it and expel the gas ; the temperature ought then to be 90° to 92°. One good grinder is that shown in figure 4.

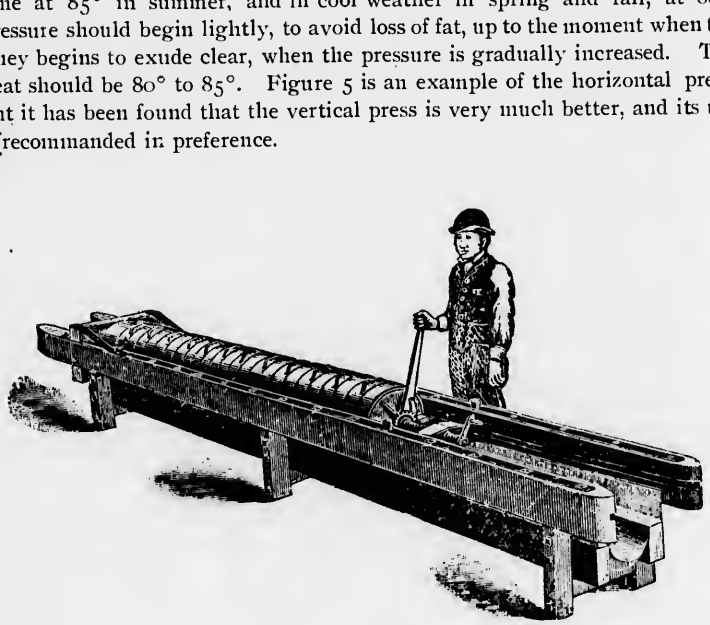


(Fig. 4) Curd Grinder

Salting.—When the curd has become soft, silky to the touch, has an aroma like fresh butter and shows signs of fat upon being pressed between the hands, it is ready for the salt, of which, in spring, it requires 1½ to 2 lbs. per 1,000 lbs. of milk ; in summer 2½ to 2¾, and 3 to 3½ in the fall ;

its temperature should then be 88° to 90°. Add the salt twice, and each time stir the curd to ensure equal mixing. Never salt till all the ga... has disappeared.

Putting into the mould and pressing.—When the salt is quite dissolved, and the curd has become once more smooth to the touch, i. e., in 15 to 25 minutes or thereabout, it can be put into moulds. This should be done at 85° in summer, and in cool weather in spring and fall, at 88°. Pressure should begin lightly, to avoid loss of fat, up to the moment when the whey begins to exude clear, when the pressure is gradually increased. The heat should be 80° to 85°. Figure 5 is an example of the horizontal press, but it has been found that the vertical press is very much better, and its use is recommanded in preference.



(Fig. 5) Horizontal Press.

After the cheese has been 45 minutes or so under press, it is taken out and its toilette made, the water used for which must be very pure; it is then returned to the press, in which it must remain for at least 20 hours before it is taken to the ripening-room. A good plan is to turn it over in the

moulds the next morning to correct all the faults in its appearance, and to put it back under press for 5 or 6 hours before placing it in the ripening room.

Ripening.—Ripening cheese should take place in a special room kept as cool as possible in summer, and not too cold in spring and fall ; say, 60° to 65°. The room ought to be well ventilated, but no currents of air should be allowed to strike the cheese.

In many factories the ripening of cheese is not now well managed, because the cheese is sold too soon, and is put to ripen in rooms where the temperature is uncontrollable, but rises in the dog-days too high and falls too low in spring and autumn. All cheese ought to be three weeks old before being sold ; at least this is the opinion of practical men. Cheese sent to market too soon is liable to acquire a bitter taste and to become soft ; the fermentation in it is arrested and it never ripens properly. If it is kept longer than three weeks, a second ripening-room, a little cooler than the former, is required.

To ripen cheese at a temperature ranging between 60° and 65°, the cheese must be made firm. For the mode of constructing a good ripening or curing room in which the temperature can be maintained between 60° and 65°, for the method of regulating the ventilation and for the advantages presented by the ripening of cheese at a low temperature, the reader is referred to the bulletin published on this head by the Department of Agriculture of Quebec, in 1899.

Aroma and Flavor.—The trade seldom distinguishes between aroma and flavor. There is, however, a vast distinction between the two, just as there is in butter : aroma is the odoriferous principle that escapes from the cheese and is perceived by the nose ; flavour is the impression produced on the gustatory nerves of the palate. Quebec cheese has, in general, the proper aroma ; the nutty flavour is often met with in it.

The bad aromas and flavours met with in cheese are the taste of fruits or of yeast ; the taste of whey, a bitter taste, and a number of other bad tastes, proceed nearly always from bad milk, bad making, dirt in the factory or in the

patrons' cans, bad water, (see on this head Bulletin No 2 on milk) or bad ripening-rooms. The trade classifies all cheese having bad aroma or bad flavor as "off flavor."

Body and texture.—The qualities of good texture are firmness, cohesion, and plasticity. A good sample is glossy and soft or smooth to the touch, "silky."

A good body, denotes a cheese that is firm and elastic. Quebec cheese has generally both a good body and good texture. Still, in some districts, the body is either too soft or too dry, and the texture is too loose.

Color.—The color of a cheese, if not artificial, ought to be pale. In the Province of Quebec, where the milk is so rich, only pale cheese should be made. The making of "dead or dull white" cheese leads to a very great loss of fat, and is, consequently, a *contre sens* (contradiction in aim) where the milk is rich; it ought to be restricted to districts where the milk is least rich. As to colored cheese, its manufacture is subject to so many mishaps that it had better never be made, unless by those who are sure of being successful.

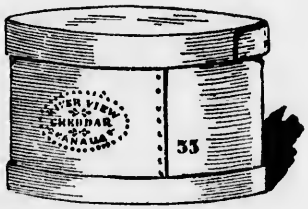
Dimensions of the moulds and boxes.—Cheese ought to be 15 inches in diameter, and 10½ to 10¾ in height, weighing 75 lbs.

The boxes ought to measure internally 15¼ ins.: ¼ of an inch more, and the same height as the cheese, i. e., they should be cut down level with the upper face of the cheese. The wood should be sound elm, without knots or cracks, and uniform in color. Bottom and cover must be of dry wood, tongued-and-grooved. Eighteen nails are sufficient for the box. The hoops of both bottom and cover should be strong, and the former be 1½ in., the other 2½ in., wide. The covers need not be nailed if they fit the box closely. The boxes are to be branded and bear the trade-mark of the factory; the cuts, taken from photographs, given below, show the difference between good and bad boxes. The trade-mark ought to be oval, and measure 6 x 3 inches (Fig. 7).

Depreciation resulting from the principal outward defects.—Dirty looking cheese suffers a loss of 1 cent per pound in price; mouldy cheese ½ a cent; cheese not standing upright from ¼ to ½ a cent; those with stripes at the top or [illegible]om ¼ cent; cloth badly cut or badly turned down

(Fig. 6)

from ¼ to ½ a cent; when there is no cotton cover ⅛ of a cent. The difference between a well turned out cheese and a shabby one may be as high as from ½ a cent to 1 cent per pound. A cracked cheese, even if of the best quality in other respects, cannot get the highest price in the market but loses at least from ¼ of a cent to 1 cent a pound.

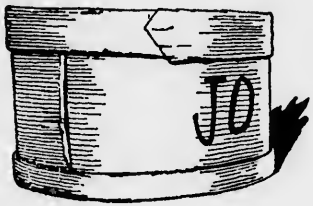


(Fig. 7)

Carriage.—As regards the carriage of cheese by rail as well as by steamer, we can only repeat what has been said about butter. Cheese is often injured in transit by heat and want of cleanliness and it is very desir-

able that there should be an improvement in this respect. The carriage of cheese from the factory to the station should be done in the evening or the morning but never, if possible, during the heat of the day; if one is compelled to do so the vehicle should be covered with a good tilt to protect the cheese from the sun. When it rains the cheeses in the vehicle should also be covered to prevent their getting dirty.

Quantity of milk required before starting a cheese factory and the rate of pay for making.—The first thing requisite for the proper working of a factory is the certainty of a sufficient supply of milk. It is easy to understand that if a factory receives only a trifling quantity of milk, it will be



(Fig. 8)

impossible to make it pay except by cutting down the maker's salary or by making inferior cheese or by attending too much to quantity instead of to quality. The income being necessarily small, the factory is fitted up as cheaply as possible, even the most requisite things being left out. In some districts small factories have been multiplied to an incredible extent; the rates for making have been lowered more and more through competition; bad milk has been habitually received as well as good and the result is that a great deal of inferior cheese has been turned out to the immense injury of the sales of cheese all over the Province. This is a most deplorable state of things and many good makers lament with reason, that they cannot compete with makers who are less careful and less scrupulous than they. Patrons ought to understand their own interests and only patronize factories that are well organized and worked by a maker holding a diploma and secure a sufficient supply of milk to ensure its proper operation. The more milk a factory receives the more can it afford to lower the charge for making and at the same

time derive a reasonable profit. The charge for making should be, for a factory pro[illegible]cing :

Four cheeses each day, at least	2	cents	per	pound.
Eight " " " "	1 ½ to 1 ¾	cent	per	pound.
Twelve " " " "	1 ¼ to 1 ½	"	"	"
Twenty " " " "	1	cent		

With reference to cheesemaking we would especially recommend the reading of "The making of Cheddar Cheese" by John W. Decker B. A. We have obtained much information from this work which is one of the best that can be consulted.

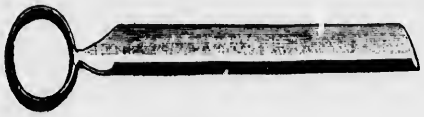
Examining and judging cheeses.—1. *General appearance.*—Is the box well made, quite round, well nailed? Is the wood sound, without knots or cracks? Has it a good color? (It must not be soaked too long and the water must be renewed.) Are the bottom and cover hoops strong enough? Are the brands clearly visible and stylishly put on? The weight should be stamped on the box. Does the cover fit the box properly? Is the box clean?

Take the cheese out of the box.—Is the box of the right size for the cheese so that the latter may come out easily? Is it not too big? Is it of the same height as the cheese? Does the cheese weigh at least 75 lbs? Is the height proportionate to the diameter? Is the cloth clean and well put on? It should not be turned down more than an inch at each end. The cloths should be put on with very hot water so as to adhere properly to the cheese. Is the surface of the cheese cracked or fissured?

General appearance of cheeses is rated from 0 to 10.

2. *Test the cheese* with a scoop (fig. 9). Smell the sample which should emit no bad odor, such as animal odor, that of ensilage or of whey. The odor should be very fresh. Odors are perceived especially at the moment when a portion of the sample is pressed with the fingers to ascertain the body.

Taste the sample.—It should have no bad taste. The taste of acids, fruit, tallow, whey, a bitter taste and many others are serious defects.



(Fig. 9.—Cheese scoop.)

A nutty taste is a good quality.

The aroma and taste are rated from 0 to 45.

The sample should not be too salt. With a little practice one can soon find out whether cheese is properly salted.

3. *Break a piece of the sample* and work it between the thumb and other fingers. It should be firm rather than soft, of silky and rather close texture and not adhere to the fingers. Holes are a serious defect as well as butter spots. It must not be damp; excess of dampness it a serious defect. The odor it best preserved when the cheese it thus worked between the fingers. Cheese should not be too green.

Grain and texture are rated from 0 to 15 and body also from 0 to 15.

The color should be uniform and not too white; it should be transparent.

Color is rated from 0 to 15.

Principles of the construction of cheese-factories.—The first thing to be considered in building a cheese factory is the power of regulating the temperature. Cheese-factories must be warm enough in spring and in autumn and cool enough in summer. They must be provided with a good ripening-room where the temperature can be constantly maintained between 65° and 70°. The walls of the cheese-making room should be solidly built and heat-proof. The floors of this room should be of two inch boards tongued

and grooved and well nailed. A coat of oil and two of varnish should be given to the walls and a coat of oil to the floor. The whey vat should be so easily accessible that cleaning it out every day may present no difficulty and there should be good ventilators in every room. The surroundings of the place should be kept perfectly clean and conduits for the drainage waters laid with great care so that they may be frequently inspected ; they should communicate with the factory by an S shaped pipe (hydraulic joint) which will prevent bad smells from the drains from entering the building. The sill or foundation of the factory should be raised high enough to allow the water used for washing to flow away easily. Pave or at least macadamize the road opposite the receiving platform.

Never place the ripening room in the garret under the roof ; this ought to be kept for storage. A good ripening-room is what is lacking in most factories and the attention of their owners must be specially directed to this point. For details as to the the construction of ripening-rooms, see the Bulletin published on this subject by the the Quebec Department of Agriculture in 1899.

The reader will find in figure 11 a plan of a cheese factory that can be recommended.

Here are the dimensions for a cheese-factory receiving the milk of from 300 to 500 cows :

Cheese making room, 28 ft. x 16 ;

Press-room, 15 x 14 ;

Engine and boiler-room, 13 ft. x 12 ;

Receiving platform, 3½ ft. ;

Shelves for the cans ;

Covered road ;

Ripening room, 36 ft. x 28.

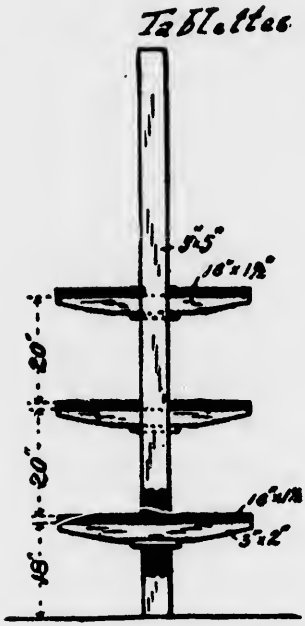
Figure 10 shows the manner of putting up the shelves in the ripening room ; they would be made of wood that will not shrink.

Plant needed for a cheese factory receiving the milk of 500 cows:

1. A 10 horse-power boiler complete ;

2. Two cheese-vats of 60 gallons each ;

3. A horizontal Fraser-press, of 12 moulds with the moulds and 12 press hoops ;



(Fig. 10).

4. A vertical press of 6 moulds with the moulds and 6 press hoops ;

5. Three strainers for the curd ;

6. A curd-mill ;

7. A can for weighing milk, capacity 500 lbs.

8. A spout to drain off the milk ;

9. A vertical and horizontal curd-knife ;

10. Weighing scales ; one for the milk up to 800 lbs with two beams ; one for the cheese and one for the salt ;

11. Two thermometers ;

12. A steam babcock complete for 24 samples ;

13. An acedimeter ;

14. An apparatus for testing milk by fermentation ;

15. An apparatus for testing milk by the curd process ;

16. A graduated 8 oz. glass ;

17. Three rakes for stirring the curd ;

18. An apparatus for putting on the cloths ;

19. A scrubbing brush and rubber scraper ;

20. Three kettles and dippers ;

21. Water and steam pipes and connections ;

22. A pump ;

23. A crane for hoisting cans ;

24. A whey-pump ;

25. A whey-vat ; capacity, 55 lbs ;

26. A water-tank ; capacity of 10 barrels ;

27. A sink ;

28. A cheese-scoop ;

29. A brand, a stencil-plate and brush for branding ;

30. A curd-pail with a flat side ;

31. A water basin ;

32. A box-making machine.

Cleanliness, care and ventilation of cheese-factories.—All that has been said in the Bulletin Nos 3 and 4 respecting creameries applies also to cheese-factories.

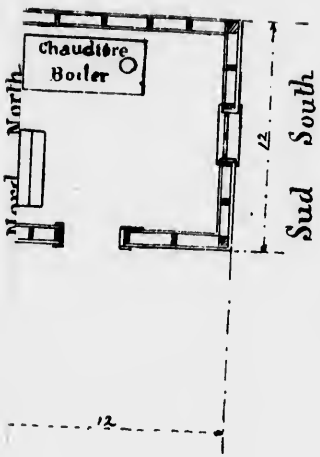
Composition of cheese and residue resulting from its manufacture. Yield of milk in cheese.—In the manufacture of cheese we get, on an average, out of 1000 lbs of milk, about 900 lbs of whey and 100 lbs of cheese.

COMPOSITION OF CHEESE AND WHEY.—(*Cooke*).

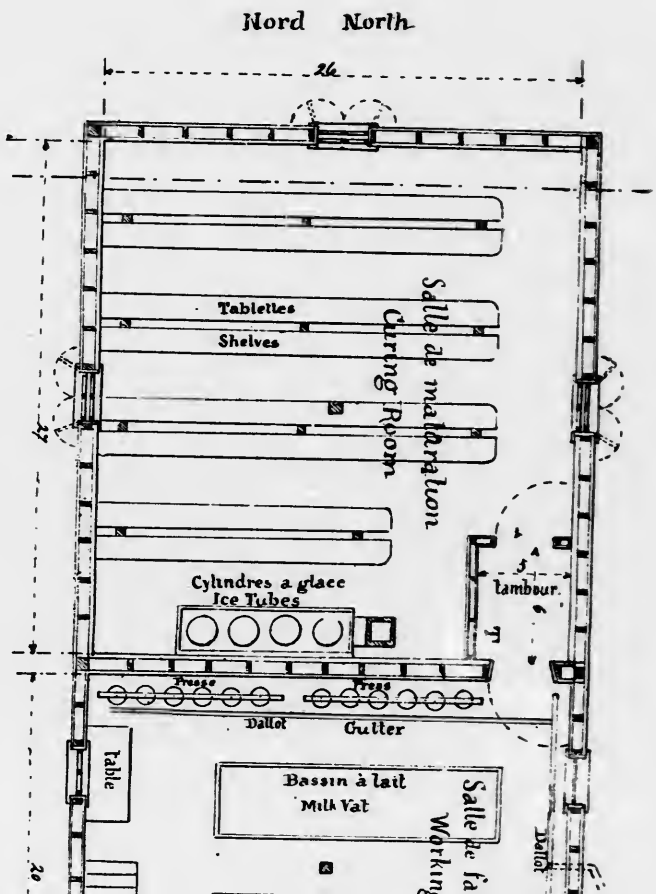
	Total solids	Fat	Caseine and Albumin	Sugar of milk	Ashes.
	per cent	per cent	per cent	per cent	per cent
Cheese	54.2	90.6	77.4	5.0	26
Drainings from press	.9	.4	.6	1.5	1
Whey	44.9	9.0	22.0	93.5	63
	100.0	100.0	100.0	100.0	100.0

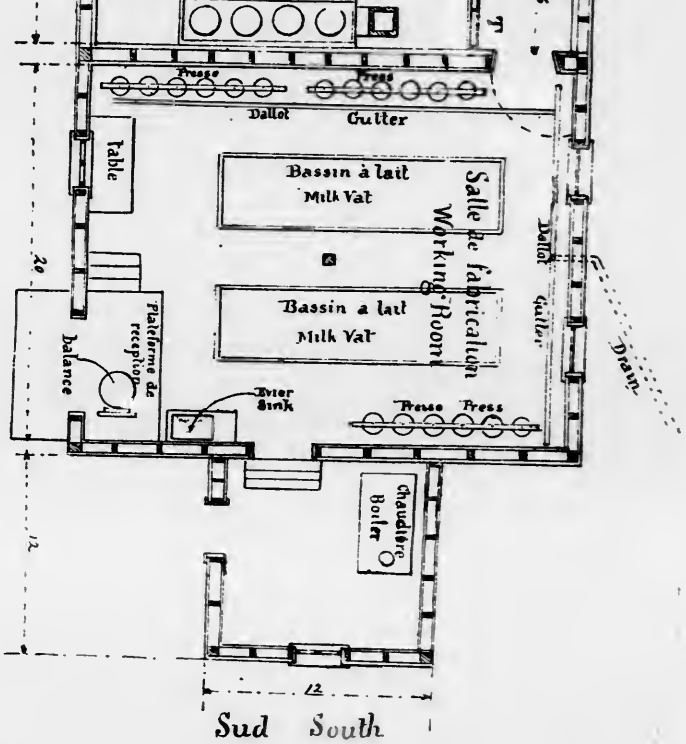
The yield of the milk in cheese may be calculated approximatively by multiplying the percentage of fat in the milk by the number 2. 7. Thus if a milk contains 3% of fat we may expect to get from it 3. 2 × 2. 7, = 8.64 lbs of cheese.

Van Slyke found that the quantity of cheese made per fat in the milk varied from 2.50 to 3.06, the average being from 2.71 to 2.73.



(Fig. 11.) Plan of a cheese factory.


Nord North
24
Tablettes
Shelves
Salle de maturation
Curing Room
Cylindres a glace
Ice Tubes
Tambour
Presse
Presse
Dallot
Gutter
Table
Bassin à lait
Milk Vat
Salle de fa
Working
Dallot
27
30



(Fig. 11.) Plan of a cheese factory.

No. of experiments	
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4	
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LOSS OF WEIGHT IN CHEDDAR CHEESE DURING RIPENING.—(*Babcock*)

No. of experiments	Period covered by each experiments.	Average age of cheese.	Number of cheese at each experiments.	Weight of all the cheese in the green stage	Weight of all the cheese after ripening.	Total loss	Loss per hundred pounds.
	days	days		lbs	lbs	lbs	per cent
1	1—10	6	99	2.812	2741.5	70.5	2.51
2	11—20	16	242	7.356.9	7.77.0	279.9	3.80
3	21—30	25	298	8.530.5	8160.4	370.1	4.34
4	31—60	41	417	12.353.3	11684.4	668.9	5.41
5	under 60	141	172	6244.4	5736.0	508.4	8.11

With a well constructed ripening room, such, for instance, as that indicated in the Bulletin on ripening rooms, published by the Department of Agriculture of Quebec, the loss of weight shown by the figures of the last column of the preceding table can be reduced by one per cent, and moreover, we can obtain, in the mean time, a far superior quality of cheese. (See the above cited bulletin, pages 35 and following.)

GABRIEL HENRY.